Complete Summary

GUIDELINE TITLE

Diagnosis and initial treatment of ischemic stroke.

BIBLIOGRAPHIC SOURCE(S)

Institute for Clinical Systems Improvement (ICSI). Diagnosis and treatment of ischemic stroke. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2008 Jun. 57 p. [146 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Institute for Clinical Systems Improvement (ICSI). Diagnosis and initial treatment of ischemic stroke. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2007 Feb. 68 p.

ICSI scientific documents are revised every 12 – 36 months as indicated by changes in clinical practice and literature.

** REGULATORY ALERT **

FDA WARNING/REGULATORY ALERT

Note from the National Guideline Clearinghouse: This guideline references a drug(s)/intervention(s) for which important revised regulatory and/or warning information has been released.

- February 28, 2008, Heparin Sodium Injection: The U.S. Food and Drug Administration (FDA) informed the public that Baxter Healthcare Corporation has voluntarily recalled all of their multi-dose and single-use vials of heparin sodium for injection and their heparin lock flush solutions. Alternate heparin manufacturers are expected to be able to increase heparin production sufficiently to supply the U.S. market. There have been reports of serious adverse events including allergic or hypersensitivity-type reactions, with symptoms of oral swelling, nausea, vomiting, sweating, shortness of breath, and cases of severe hypotension.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

- Ischemic stroke
- Transient ischemic attack (TIA)

GUIDELINE CATEGORY

Diagnosis
Evaluation
Management
Screening
Treatment

CLINICAL SPECIALTY

Emergency Medicine
Family Practice
Internal Medicine
Neurology

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Emergency Medical Technicians/Paramedics
Health Care Providers
Health Plans
Hospitals
Managed Care Organizations
Nurses
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

- To increase the percentage of patients presenting within three hours of stroke onset who are evaluated within 10 minutes of arriving in the emergency department (ED)

- To increase the percentage of patients presenting with transient ischemic attack (TIA) symptoms within 24 hours at high risk for stroke who are admitted to the hospital
- To increase the percentage of patients receiving appropriate thrombolytic and antithrombotic therapy for ischemic stroke (use of tissue plasminogen activator [tPA] and aspirin)
- To increase the percentage of non-tPA recipients who have hypertension appropriately managed in the first 48 hours of hospitalization or until neurologically stable
- To increase the percentage of patients who receive appropriate medical management for prevention of complications within the initial 24 to 48 hours of diagnosis
- To improve patient and family education of patients with ischemic stroke in both the ED and the admitting hospital unit

TARGET POPULATION

Patients age 18 years or older with symptoms of ischemic stroke or transient ischemic attack

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis/Evaluation/Screening

1. Emergency department (ED) or clinic evaluation, as appropriate
2. History and physical examination, including neurologic examination (use of National Institutes of Health Stroke Scale [NIHSS]), risk assessment using ABCD and ABCD^2 scores, and establishing time of symptom onset
3. Screening for tissue plasminogen activator (tPA) treatment indications and contraindications
4. Diagnostic testing, such as laboratory testing (e.g., complete blood count, electrolytes, blood urea nitrogen, creatinine, glucose, international normalized ratio, partial thromboplastin time, troponin, aspartate aminotransferase [AST], urine or serum pregnancy testing), electrocardiogram, brain and vascular imaging (e.g., computed tomography [CT] of the head without contrast, CT angiography of head and neck, magnetic resonance imaging [MRI], diffusion-weighted MRI, CT or carotid ultrasound), cardiac monitoring
5. Other cardiac assessment (telemetry) as appropriate
6. Considering if intra-arterial thrombolysis is appropriate

Management/Treatment

1. Education of patient/family regarding diagnosis, ED process, tests, treatment and risks
2. Blood pressure (BP) management
3. Measures to treat hyperthermia or hypo-/hyperglycemia
4. Intravenous (IV) fluids (normal saline)
5. tPA
6. Aspirin or other antithrombotics
7. Post ED management
    - Hospital care in intensive care unit or acute stroke unit/cardiac monitoring

- Physical examinations, including vital signs and neurologic checks
- BP management (monitoring and treating with easily titrated agents, such as labetalol, nitroprusside, nitropaste, or nicardipine)
- Bleeding precautions
- Monitoring for complications of therapy
- Continued treatment of hyperthermia or hypo-/hyperglycemia
- Continued IV fluids
- Deep vein thrombosis prophylaxis with low dose heparin, low-molecular-weight heparin (e.g., enoxaparin) or heparinoids; intermittent pneumatic compression
- Swallow evaluation
- Early rehabilitation
- Nutritional status assessment
- Early treatment of ischemic brain edema

MAJOR OUTCOMES CONSIDERED

- Early stroke recurrence
- Stroke progression
- Mortality due to stroke
- Disability due to stroke

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

A literature search of clinical trials, meta-analysis, and systematic reviews is performed.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Classes of Research Reports:

A. Primary Reports of New Data Collection:

Class A:

- Randomized, controlled trial

Class B:

- Cohort study

Class C:

- Nonrandomized trial with concurrent or historical controls
- Case-control study
- Study of sensitivity and specificity of a diagnostic test
- Population-based descriptive study

Class D:

- Cross-sectional study
- Case series
- Case report

B. Reports that Synthesize or Reflect upon Collections of Primary Reports:

Class M:

- Meta-analysis
- Systematic review
- Decision analysis
- Cost-effectiveness analysis

Class R:

- Consensus statement
- Consensus report
- Narrative review

Class X:

- Medical opinion

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

New Guideline Development Process

A new guideline, order set, and protocol is developed by a 6- to 12-member work group that includes physicians, nurses, pharmacists, other healthcare professionals relevant to the topic, along with an Institute for Clinical Systems Improvement (ICSI) staff facilitator. Ordinarily, one of the physicians will be the leader. Most work group members are recruited from ICSI member organizations, but if there is expertise not represented by ICSI members, 1 or 2 members may be recruited from medical groups or hospitals outside of ICSI.

The work group will meet for seven to eight three-hour meetings to develop the guideline. A literature search and review is performed and the work group members, under the coordination of the ICSI staff facilitator, develop the algorithm and write the annotations and footnotes and literature citations.

Once the final draft copy of the guideline is developed, the guideline goes to the ICSI members for critical review.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Critical Review Process

Every newly developed guideline or a guideline with significant change is sent to the Institute for Clinical Systems Improvement (ICSI) members for Critical Review. The purpose of critical review is to provide an opportunity for the clinicians in the member groups to review the science behind the recommendations and focus on the content of the guideline. Critical review also provides an opportunity for clinicians in each group to come to consensus on feedback they wish to give the work group and to consider changes necessary across systems in their organization to implement the guideline.

All member organizations are expected to respond to critical review guidelines. Critical review of guidelines is a criterion for continued membership within the ICSI.

After the critical review period, the guideline work group reconvenes to review the comments and make changes, as appropriate. The work group prepares a written response to all comments.

Approval

Each guideline, order set, and protocol is approved by the appropriate steering committee. There is one steering committee each for Respiratory, Cardiovascular, Women's Health, and Preventive Services. The Committee for Evidence-based Practice approves guidelines, order sets, and protocols not associated with a particular category. The steering committees review and approve each guideline based on the following:

- Member comments have been addressed reasonably.
- There is consensus among all ICSI member organizations on the content of the document.
- Within the knowledge of the reviewer, the scientific recommendations within the document are current.
- Either a critical review has been carried out, or to the extent of the knowledge of the reviewer, the changes proposed are sufficiently familiar and sufficiently agreed upon by the users that a new round of critical review is not needed.

Once the guideline, order set, or protocol has been approved, it is posted on the ICSI Web site and released to members for use. Guidelines, order sets, and protocols are reviewed regularly and revised, if warranted.

Revision Process of Existing Guidelines

ICSI scientific documents are revised every 12 to 36 months as indicated by changes in clinical practice and literature. Every 6 months, ICSI checks with the work group to determine if there have been changes in the literature significant enough to cause the document to be revised earlier than scheduled.

Prior to the work group convening to revise the document, ICSI members are asked to review the document and submit comments. During revision, a literature search of clinical trials, meta-analysis, and systematic reviews is performed and reviewed by the work group. The work group will meet for 1-2 three-hour meetings to review the literature, respond to member organization comments, and revise the document as appropriate.

If there are changes or additions to the document that would be unfamiliar or unacceptable to member organizations, it is sent to members to review prior to going to the appropriate steering committee for approval.

Review and Comment Process

ICSI members are asked to review and submit comments for every guideline, order set, and protocol prior to the work group convening to revise the document.

The purpose of the Review and Comment process is to provide an opportunity for the clinicians in the member groups to review the science behind the

recommendations and focus on the content of the order set and protocol. Review and Comment also provides an opportunity for clinicians in each group to come to consensus on feedback they wish to give the work group and to consider changes needed across systems in their organization to implement the guideline.

All member organizations are encouraged to provide feedback on order sets and protocol, however responding to Review and Comment is not a criterion for continued membership within ICSI.

After the Review and Comment period, the work group reconvenes to review the comments and make changes as appropriate. The work group prepares a written response to all comments.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Note from the National Guideline Clearinghouse (NGC) and the Institute for Clinical Systems Improvement (ICSI): For a description of what has changed since the previous version of this guidance, refer to Summary of Changes Report -- June - 2008.

The recommendations for the diagnosis and initial treatment of ischemic stroke are presented in the form of three algorithms with 38 components, accompanied by detailed annotations. Algorithms are provided for: Screening (Ambulatory), Emergency Department Treatment, and Stroke Code; clinical highlights and selected annotations (numbered to correspond with the algorithm) follow.

Class of evidence (A-D, M, R, X) definitions are repeated at the end of the "Major Recommendations" field.

Clinical Highlights

- Patients presenting with signs and symptoms of transient ischemic attack (TIA) should be evaluated for risk of immediate future events using the ABCD score. (*Annotation #23*)
- Patients who present in time to be candidates for treatment with tissue plasminogen activator (tPA) should be evaluated by a physician within 10 minutes, undergo a computed tomography (CT) scan within 25 minutes of arrival in the emergency department (ED), and have CT interpreted within 20 minutes of test completion. (*Annotations #29*)
- Intravenous (IV) tPA, if given, should be administered within three hours of stroke onset and less than 60 minutes of arrival at the ED. (*Annotations #29, 30, 33, 37*)
- Patients presenting with stroke onset who are not candidates for intravenous tPA should promptly be given aspirin, after exclusion of hemorrhage on CT scan. (*Annotation #35*)
- Education regarding early stroke symptoms, risk factors, diagnostic procedures, and treatment options should be offered to the patient and family. This should be documented in the patient chart. (*Annotation #31*)

- Medical management for prevention of complications within the initial 24 to 48 hours of diagnosis and initial treatment of ischemic stroke include: (*Annotation #38*)
    - Continue appropriate blood pressure management
    - Continue to treat hyperthermia
    - Continue to treat hypo- or hyperglycemia
    - Continue IV fluids
    - Initiate deep vein thrombosis prophylaxis
    - Perform swallow evaluation
    - Initiate early rehabilitation
    - Perform nutritional status assessment

Screening (Ambulatory) Algorithm Annotations

1. **Initial Contact with Patient and Complaint of Neurological Symptoms**

   This contact may occur with one of several medical system personnel, including primary care physicians, other medical specialty physicians, emergency medical personnel, nursing staff in a clinic or urgent care setting or even non-medical triage personnel. This does not refer to the ED evaluation. This contact may be by phone or in person. Potential staff contacts should be educated in the importance of stroke symptom recognition and the appropriate triage measures that should be taken.

2. **Immediate Screening for Ischemic Stroke**

   This should include detail as to the location, severity, duration of symptoms, and any aggravating or relieving factors. Symptoms that are commonly associated with ischemic stroke or transient ischemic attack (TIA) include:*

   - Sudden numbness or weakness of the face, arm, or leg--especially on one side of the body
   - Sudden mental confusion, trouble speaking or understanding
   - Sudden trouble walking, dizziness, loss of balance or coordination
   - Sudden trouble seeing in one or both eyes
   - Sudden severe headache with no known cause

   * List from American Stroke Association for public education

   The American Stroke Association, American Academy of Neurology and American College of Emergency Physicians have recently launched a public awareness campaign entitled "Give Me 5" emphasizing that stroke typically presents as problems of walking, talking, reaching, seeing and/or feeling.

   Symptoms of ischemic stroke can also, of course be represented in atypical ways.

   Clinical diagnoses with neurologic symptoms that may imitate or superficially resemble ischemic stroke or TIA include the following *[R]*:

   - **Migraine**

Neurologic symptoms experienced with migraine tend to have a more gradual onset and slower development. However, the two problems may be indistinguishable.

- **Seizures**

  Although seizures typically consist of a "positive" phenomenon (jerking of a limb) rather than loss of neurologic function (weakness or paralysis of a limb), symptoms and signs during the ictus or in the postictal state may be similar to ischemic stroke (e.g., confusion or speech arrest during the ictus as in complex partial seizure, postictal confusion, postictal paralysis, and other sensory or visual phenomenon.)

- **Syncope**
- **Transient global amnesia**

  This is characterized by a sudden onset antegrade and retrograde memory disturbance without other neurologic symptoms. If the patient experiences symptoms of transient global amnesia it would be inappropriate to assume the diagnosis without a complete neurologic exam.

- **Peripheral nerve disorders**

  Mononeuropathy and radiculopathy can be distinguished from ischemic stroke by the anatomic distribution of the symptoms and in the case of radiculopathy, by the associated painful symptoms. Bell's palsy, vestibular neuritis and extraocular muscle imbalance due to cranial neuropathy may also imitate ischemic stroke; a complete history and neurologic examination is required to accurately differentiate from ischemic stroke.

- **Intracranial hemorrhage**
- **Other intracranial masses, (e.g., tumor, abscess [often differentiated by CT])**

  The mode of onset and early course tend to be more gradual in development but mimicry of stroke is not uncommon.

- **Neuroses**

  Neuroses such as anxiety or panic disorder may need to be considered in some cases.

- **Metabolic disorders**

Hypoglycemia is the most common metabolic disorder producing neurologic symptoms that imitate stroke. A patient with known diabetes or liver disease should be screened for hypoglycemia.

This discussion is not meant to be a detailed guide to discerning between ischemic stroke and other diagnoses. If there is any uncertainty as to symptom causation, the evaluation should proceed as though ischemic stroke or TIA is confirmed so as not to delay appropriate emergency treatment if needed.

4. **Refer to ED or Physician's Office as Appropriate for Other Conditions**

   Some of the diagnoses outlined in Annotation #2, "Immediate Screening for Ischemic Stroke," may warrant ED evaluation because of the urgency of the problem itself or the inability of the contact person to distinguish the other condition from ischemic stroke *[R]*. In these uncertain cases, the contact person should continue on to box #5 in the Screening (Ambulatory) Algorithm.

5. **Symptoms Present Now?**

   Refers to ongoing symptoms suggestive of cerebral ischemia. If symptoms have resolved and were present for less than 24 hours, this is clinically defined as a TIA.

6. **Possible Ischemic Stroke -- Symptoms Onset within 24 Hours?**

   Key Point:

   - The onset of symptoms should be defined as the last time the patient was known to be normal or at previous pre-stroke baseline.

   If the symptoms resolve completely and then recur, for the purposes of determining whether thrombolysis can be considered for stroke, the time of onset would be the last time the patient was normal (just prior to the onset of the second set of symptoms). Patients may be unable to give this information if they have an aphasia or mental confusion. Family members or other witnesses may need to give this information. If the patient was sleeping and awoke with the problem, the time of onset would be the moment the patient was last known to be normal just before falling asleep.

7. **Ischemic Stroke Symptoms Present for >24 Hours/Symptoms Mild and Stable**

   Patients with stable mild deficits present longer than 24 hours may be transported to the ED for evaluation and treatment by means other than 911. As a rule, they should be admitted to the hospital to assure thorough and expeditious evaluation and treatment. Outpatient evaluation and treatment is an acceptable alternative if it can be done as quickly as it could be done inpatient and if all goals of inpatient assessment (diagnosis of mechanism,

initiation of appropriate secondary prevention, prevention of complications, early assessment for and deployment of rehabilitative services) can be successfully addressed.

9. **Possible TIA -- Symptoms Within Two Hours?**

   Patients presenting with history suggestive of TIAs may have neurological deficits they are unaware of. To avoid missing the thrombolytic treatment window, patients with possible TIAs presenting within two hours of symptom onset should be triaged like patients with stroke (i.e., call 911) *[R]*.

11. **Transport to ED**

    Patients should be taken to the ED expeditiously; use of 911 Emergency is at the provider's discretion. Alternatively, if such a program were available, the patient may be assessed in a specialized clinic or other program in which the evaluation can be carried out as quickly and treatment initiated as definitively as if the patient were admitted to the hospital. This work group otherwise recommends that the physician strongly consider hospitalization for TIA patients who appear within 24 hours of the event to expedite workup and possibly administer tPA if the deficit recurs.

13. **Rapid Outpatient Evaluation or Admit to Hospital**

    Patients should receive rapid outpatient evaluation (TIA clinic or other program) or be admitted to the hospital as soon as possible *[R]*. In addition to a risk assessment for stroke, the patient should be diagnostically evaluated for:

    - If symptoms suggest ischemia in the carotid distribution, carotid imaging, ultrasound, computed tomography angiography (CTA) or magnetic resonance angiography (MRA)
    - Cardiac rhythm assessment
    - Echocardiogram (if suspect cardioembolic source)

Emergency Department Treatment Algorithm Annotations

18. **Consider IV tPA/See Stroke Code Algorithm**

    Key Points:

    - Treatment with IV tPA should begin within three hours (180 minutes) of symptom onset
    - Patients with persisting symptoms presenting to the ED within 150 minutes of symptom onset should be evaluated rapidly for treatment with IV tPA
    - Occasionally, patients may be able to receive IV tPA even if they present later than 150 minutes if their work-up, such as laboratory evaluation, has been completed and they have other aspects, such IV access in place

- Intra-arterial thrombolysis may be an option for treatment of selected patients who have a major stroke with symptoms onset less than six hours previous due to occlusion of the middle cerebral artery (MCA) or basilar artery or who are not otherwise candidates for intravenous tPA if the patient can be treated in a timely manner at an experienced stroke center with immediate access to cerebral angiography and qualified interventionalists. (A protocol for intra-arterial thrombolysis will be institutional specific and is out of the scope of this guideline.)

Patients presenting to the ED soon after the onset of symptoms may be candidates for treatment with IV tPA and will therefore require a rapid evaluation and treatment initiation *[R]*. Although the time window from onset of symptoms to treatment can be up to 180 minutes, the evaluation in the ED will require at least 30 minutes in most cases (CT scan of head, laboratory tests performed and results returned, IV access obtained, and neurological exam and history) *[R]*. The guideline committee has therefore chosen 150 minutes as a practical cutoff time for this triage decision.

There are important exceptions to this time limitations guideline for triage of the patients into the "Stroke Code" process. In certain instances, the time required for evaluation may be shorter and "stroke code" may be feasible for patients presenting as late as 165 or 170 minutes after onset. One example would be the patient who is already in the hospital and has undergone the appropriate laboratory evaluation, has an IV access in place, and much of the history is already known. In that case, a brief neurologic exam and rapid evaluation with CT may be the only items required prior to treatment and could theoretically be performed in 10 to 15 minutes.

Refer to the original guideline document for information on tPA tested in large, randomized, placebo-controlled clinical trials.

21. **ED Diagnostic Evaluation**

Patients with a history suggestive of TIA should be evaluated promptly *[R]*. The following diagnostic evaluations should be performed *[C]*, *[D]*, *[R]*. The speed and venue of the assessment described below will depend on the currency of the symptoms and the physician's assessment of risk of early recurrence of TIA or the development of stroke. The work group recommends that patients presenting less than 24 hours since initial TIA with high risk symptoms (see Annotation #23, "High Risk for Stroke?") generally not leave the ED until the following are completed or scheduled within the next few hours on an inpatient basis.

- **Laboratory Tests**
  - Complete blood count
  - Glucose
  - Electrolytes (sodium, potassium, chloride, CO_2)
  - Sedimentation rate (ESR)
- **Electrocardiogram (EKG)**
- **Brain and Vascular Imaging** *[D]*
  - Magnetic resonance imaging (MRI)/MRA
  - CT/computed tomography angiography (CTA)

- CT/carotid ultrasound, if symptoms referable to carotid distribution

Brain Imaging

If the patient is not having symptoms at the time of presentation, a diffusion-weighted MRI (DW-MRI) is preferred, if available. Restricted diffusion in the setting of a possible transient ischemic attack identifies higher risk of stroke. At this time, an MRA of the carotids and brain can be performed.

If MRA is not available, a CT of the head would be indicated and if feasible, a CTA of the head and neck can also be performed *[B]*, *[D]*.

23. **High Risk for Stroke?**

Key Points:

- Risk of stroke is greatest in the immediate aftermath of TIA or minor stroke.
- Features of presentation define those at highest risk.
- Hospitalization should be strongly considered for those at highest risk.

Analysis of the Oxfordshire population-based sample of TIA episodes (n=209) yielded the ABCD score identifying those at high risk of stroke *[B]*.

The elements of the scale from this derivation sample are:

A – for age	Over the age of 60 years	1 point
B – for blood pressure	A systolic greater than 140 mm Hg or diastolic greater than 90 mm Hg	1 point
C – for clinical features	Unilateral weakness	2 points
	Speech disturbance without weakness	1 point
	Other clinical features	0 points
D – for duration of symptoms	Symptoms lasting greater than 60 minutes	2 points
	Symptoms lasting 10–59 minutes	1 point
	Symptoms lasting less than 10 minutes	0 points
7-day risk of stroke 0-4 points: 0.4% 5 points: 12.1% 6 points: 31.4%		

Recently, the group from Kaiser Permanente (California Score) and Oxford (ABCD Score) together, validated the two similar prognostic scores in four

independent groups of patients and generated a new unified score (the ABCD^2 Score) to predict the risk of stroke in the two days following a TIA *[C]*. This new score was derived and validated in patients seen in emergency departments and outpatient clinics and is a more accurate predictor than either of the two previous scores (California score and ABCD score) in the derivation and validation groups. This score also predicted the risk of stroke within two days, which is more useful in the outpatient setting. Data from the validation groups included 4,799 patients.

A – for age	60 years or older	1 point
B – for blood pressure	A systolic 140 mm Hg or greater or diastolic 90 mm Hg or greater	1 point
C – for clinical features	Unilateral weakness	2 points
	Speech disturbance without weakness	1 point
D – for duration of symptoms	Symptoms lasting greater than 60 minutes	2 points
	Symptoms lasting 10–59 minutes	1 point
	Symptoms lasting less than 10 minutes	0 points
D ^{2} – Diabetes		1 point
Risk of stroke at two days: Low risk (0-3 points): 1.0% Moderate risk (4-5 points): 4.1% High risk (6-7 points): 8.1%		

Based on these results, the authors suggest admitting patients who present with a TIA and have an ABCD^2 score of 4 or greater.

These reports highlighted the frequent early occurrence of stroke and other cardiovascular events and the validity of risk stratification schemes. It has not been clear whether hospitalization or expedited outpatient management would help to mitigate high risk. Very recently, it has been shown that deployment of streamlined systems that address TIAs very quickly (e.g., within 24 to 48 hours) with definitive diagnostic testing and initiation of secondary prevention are associated with reducing the rate of early stroke.

At present, the work group is not prepared to recommend that patients be selected for hospitalization based solely on the ABCD^2 scheme. It recognizes that it may be being used in that way in some hospitals in the region and encourages that the effectiveness of the approach be monitored in those hospitals.

In summary, the work group recommends consideration of hospitalization for patients with first TIA within the past 24 to 48 hours to facilitate early

deployment of lytic therapy, if necessary, and to expedite institution of definitive secondary prevention. For others, the risk stratification data described above might also justify hospitalization rather than expedited ambulatory management. Whatever the strategy, speed is key. Patients managed in the outpatient setting should be fully educated about the need to return immediately if symptoms recur, to allow use of lytic therapy *[R]*.

Refer to the original guideline document for additional information on risk assessment which can help identify patients at high risk of stroke.

24. **Admit to Monitored Unit**

Patients with TIA symptoms within 24 to 48 hours and at high risk for stroke (see Annotation #23, "High Risk for Stroke?") should be admitted to a monitored unit for observation and further evaluations. Admitting patients expedites diagnostic evaluation, allows for ready access to fibrinolysis should the patient have an acute stroke, facilitates early carotid revascularization if indicated, and offers greater opportunity for risk factor modification for secondary stroke prevention. Expedited outpatient programs may be equivalent (see Annotation #26, "Rapid Outpatient Evaluation or Admit to Hospital").

The following diagnostic evaluations should be performed *[R]*:

- **Laboratory Tests**
  - Complete blood count
  - Glucose
  - Electrolytes (sodium, potassium, chloride, CO_2)
  - Sedimentation rate (ESR)
- **Electrocardiogram**
- **Brain and Vascular imaging** *[D]*
  - MRI/MRA
  - CT/CTA
  - CT/carotid ultrasound, if symptoms referable to carotid distribution

26. **Rapid Outpatient Evaluation or Admit to Hospital**

Patients with TIA symptoms that occurred more than 24 hours ago but within the last seven days should be evaluated as soon as possible *[R]*. Organizations have started TIA clinics for the rapid evaluation of patients in the outpatient setting. Patients who cannot be evaluated rapidly as an outpatient should be admitted to the hospital. The following diagnostic evaluations should be performed within 48 hours:

- **Laboratory Tests**
  - Complete blood count
  - Glucose
  - Electrolytes (sodium, potassium, chloride, CO_2)
  - Sedimentation rate (ESR)
- **Electrocardiogram**
- **Brain and vascular imaging** *[D]*

- MRI/MRA
- CT/CTA
- CT/carotid ultrasound, if symptoms referable to carotid distribution

Stroke Code Algorithm Annotations

29. **Admit and Begin Stroke Code**

Key Points:

- The "door to first physician contact" goal is within 10 minutes.
- The "door to initiation of CT scan" goal is within 25 minutes.
- The "door to drug" goal for thrombolytic treatment is within 60 minutes.

The guideline committee uses the term "stroke code" to refer to a process in the ED for the rapid evaluation and treatment of patients who have presented in a time frame qualifying them for thrombolytic therapy. This process may take many forms. It might include a formal "stroke team" that is called whenever a possible candidate for tPA has presented or it may include the ED staff who have been trained in the rapid evaluation and treatment of stroke patients. The general concept is one that includes the following:

- Rapid triage of patients as soon as they arrive in the ED
- Immediate initiation of phlebotomy for appropriate blood tests followed by CT scan
- First physician contact for history and exam occurring early in the ED visit. The National Institutes of Health (NIH) recommendation for timing of "door to first physician contact" for thrombolytic candidates is within 10 minutes.
- Rapid access to the best neurologic and radiologic expertise for evaluation of the patient and to the CT scan prior to treatment.

  This may include a neurologist and neuroradiologist present at the time of treatment. Alternatively, it may be a primary care physician with expertise in stroke diagnosis and administration of tPA and a general radiologist with expertise in reviewing head CT scans. The NIH recommendation for the timing of "door to initiation of CT scan" for thrombolytic candidates is within 25 minutes.

- The goal of the stroke code should be to rapidly administer tPA in appropriately screened candidates. The NIH recommendation for the timing of "door to drug" for thrombolytic treatment is within 60 minutes *[R]*.

30. **Evaluation (Should Occur Concurrently with Intervention)**

Key Points:

- Apart from history and examination (National Institute of Health Stroke Scale [NIHSS]) relevant to thrombolytic therapy, CT scan and glucose, other tests are not necessary before administering IV tPA. Obtaining them should not delay treatment.
- Review tPA indications/contraindications and document as to whether patient is eligible.
- Perform baseline NIHSS.
- Draw blood for lab tests.
- Perform EKG.
- Perform noncontrast head CT to exclude hemorrhage.

Review History and tPA Treatment Indications and Contraindications and Baseline NIHSS

Take a complete patient history, including a review of indications and contraindications for treatment with tPA *[R]*.

The recommendations for treatment indications and contraindications were modified from the ICSI Technology Assessment Work Group for tPA for Acute Ischemic Stroke. They are based upon the National Institute of Neurologic Disorders and Stroke (NINDS) study recommendations with amendments to include recommendations from clinical practice at Mayo Clinic and treatment guidelines from the Stroke Treatment in the Community study *[D]*.

See ICSI technology assessment Tissue-type Plasminogen Activator for Acute Ischemic Stroke (TA #28, 2005) for more information.

Indications for tPA

- Acute onset of focal neurological symptoms, consistent with ischemic stroke
- Clearly defined onset of stroke less than three hours prior to planned start of treatment; if the patient awakens with symptoms, onset is defined as the time of the last known baseline neurological status prior to retiring
- Eighteen years of age or older
- CT scan does not show evidence of intracranial hemorrhage, nonvascular lesions (e.g., brain tumor, abscess) or signs of advanced cerebral infarction such as sulcal edema, hemispheric swelling, or large areas of low attenuation consistent with extensive volume of infarcted tissue
- A patient with a seizure at the time of onset of stroke may be eligible for treatment as long as the physician is convinced that residual impairments are secondary to stroke and not a postictal phenomenon *[R]*)

Contraindications for tPA

The clinical, history, laboratory, and radiological contraindications for thrombolytic therapy (tPA) that are listed below should be considered relative contraindications. Clinical judgment should weigh the patient's risk for receiving tPA compared with the benefits of thrombolytic therapy.

Clinical Contraindications

- Clearly defined onset of stroke greater than three hours prior to planned start of treatment; if the patient awakens with symptoms, onset is defined as the time of the last known baseline neurological status prior to retiring
- Rapidly improving symptoms
- Mild stroke symptoms/signs (NIHSS less than 4)
    - Sensory symptoms only
    - Ataxia without other deficits
    - Dysarthria without other deficit
    - Mild motor signs (non-disabling)
    - Visual field defect without other deficit
- In the setting of middle cerebral artery (MCA) stroke, an obtunded or comatose state may be a relative contraindication.
- Clinical presentation suggestive of subarachnoid hemorrhage regardless of CT result
- Hypertension--systolic blood pressure (SBP) greater than 185 mm Hg or diastolic blood pressure (DBP) greater than 110 mm Hg

  Patients with an SBP greater than 185 mm Hg or DBP greater than 110 mm Hg are excluded only if the blood pressure remains elevated on consecutive measurements, or if aggressive treatment is required to lower the blood pressure into an appropriate range.

  Throughout this guideline, the work group frequently refers to blood pressure limits that are represented as systolic/diastolic. These ranges are intended to show the blood pressure limits as exceeding as either a given systolic level **OR** a given diastolic level.

History Contraindications

- Minor ischemic stroke within the last month
- Major ischemic stroke or head trauma within the last three months
- History of intracerebral or subarachnoid hemorrhage if recurrence risk is substantial
- Untreated cerebral aneurysm, arteriovenous malformation (AVM), or brain tumor
- Gastrointestinal or genitourinary hemorrhage within the last 21 days
- Arterial puncture at a noncompressible site within the last seven days or lumbar puncture within the last three days
- Major surgery or major trauma within the last 14 days
- Clinical presentation suggestive of acute myocardial infarction (MI) or post-MI pericarditis
- Patient taking oral anticoagulants and international normalized ratio (INR) greater than 1.7
- Patient receiving heparin within the last 48 hours and having an elevated activated partial thromboplastin time (aPTT)
- Patient receiving low-molecular-weight heparin within the last 24 hours
- Pregnant, or anticipated pregnant, female

- Known hereditary or acquired hemorrhagic diathesis or unsupported coagulation factor deficiency

Laboratory Contraindications

Glucose should always be measured prior to giving tPA; other parameters should be checked before treatment if there is reason to believe they may be abnormal (e.g., INR and aPTT should be checked if patient has been exposed recently to warfarin or heparin or if there is history of liver disease).

- Glucose less than 50 or greater than 400 mg/dL
- Platelet count less than 100,000/mm^3
- INR greater than 1.7
- Elevated aPTT
- Positive pregnancy test

Radiology Contraindications

- Intracranial hemorrhage
- Large area of low attenuation consistent with an infarcted brain

  Early changes of this type suggest that onset of symptoms occurred earlier than the history first indicated. Recheck patient history and time of symptom onset.

- Intracranial tumor, aneurysm, arteriovenous malformation (AVM) or other space-occupying lesion

Once indications and contraindications have been reviewed, the patient should be appropriately managed and documentation of why tPA was given or not given must occur.

Baseline NIHSS

A history and neurological examination must be performed to assess whether the presentation is consistent with a stroke diagnosis and to estimate the severity of the deficit *[R]*. Use of the NIHSS by physicians and nursing staff is encouraged, as the scale provides a uniform method of evaluation to facilitate comparison between examiners during the early hours of the stroke care. The work group encourages use of the NIHSS as an initial evaluation tool and after resuscitation or treatment to assess for change.

The NIHSS is a quantitative measure of neurologic deficit in stroke patients that covers the key aspects of the neurological exam, including level of consciousness and orientation, eye movements, visual fields, facial weakness, motor strength in limbs, coordination, sensation, language and comprehension of language, articulation, and neglect. It can be performed in rapid fashion (five to eight minutes), which is an important feature in this clinical setting *[R]*.

The NIHSS has been demonstrated in several evaluations to have both validity and reliability.

Refer to the original guideline document for more information on baseline NIHSS.

Perform Vital Signs Every 15 Minutes with Neuro Checks (Not NIHSS)

It is the standard of practice to perform a baseline NIHSS neurological assessment *[R]*. For subsequent neuro checks, a less extensive tool is appropriate. Performing a full NIHSS assessment every 15 minutes is often not feasible and may not be a good use of time. There is no evidence showing that performing a full NIHSS assessment every 15 minutes improves patient outcomes or improves the assessment and early detection of changes in patient condition. Unfortunately, there is not a standard validated non-NIHSS neurological assessment that is utilized by health care providers or that has been studied.

The work group has gathered the abbreviated neurological assessments used by several organizations and proposes the following non-NIHSS neuro check as an option.

Level of Consciousness – measures the level of alertness of the patient

- Is the patient alert, alert with stimulation or requires repeated stimulation to remain alert, or comatose?
- Is the patient able to correctly mouth his/her name and age?
- Is the patient able to correctly follow simple commands of opening and closing his/her eyes?

Motor Functions – measures the motor functions and patient's ability to follow commands

- Is the patient able to perform a series of arm movements?
- Is the patient able to perform a series of leg movements?

Language Skills – measures the amount of aphasia and dysarthria in response to asking patients to describe an item or read several sentences

See Appendix B in the original guideline document for examples of non-NIHSS neuro check forms.

The work group would like to encourage organizations to measure the use of non-NIHSS assessment tools to grow the evidence in this area.

Record Weight (estimate if needed)

Draw Blood for Lab Tests

Necessary/critical laboratory tests (results must be available before treatment in all cases):

- Glucose
- Prothrombin time (PT)/INR (if patient on warfarin)

Recommended laboratory tests (results must be available before treatment if physical exam and/or patient history indicates the possibility of abnormal results):

- Complete blood count (CBC) with platelet count
- Electrolytes, blood urea nitrogen (BUN), creatinine
- PT/INR, aPTT

Others to consider:

- Troponin
- Aspartate aminotransferase (AST)

These tests are used to evaluate for dehydration, metabolic disorders which might influence neurologic status (especially hypoglycemia and hyperglycemia), hematologic disorders such as polycythemia which may affect cerebral perfusion, or coagulopathies that could affect the treatment decision *[R]*. Prior to administration of tPA, the glucose level should be reviewed. If the patient is known to be on warfarin or has received heparin within the last 24 hours, the prothrombin time and partial thromboplastin time should be reviewed prior to treatment. A urine or serum pregnancy test should be obtained in women of childbearing potential if there is substantial reason to believe the patient may be pregnant.

Perform EKG

An EKG should be performed for the purpose of screening for concomitant cardiac disease, either acute or chronic, that may impact immediate treatment decisions.

Perform CT Head without Contrast

A CT scan without contrast must be performed prior to treatment with tPA, primarily for the purpose of excluding hemorrhage. Early signs of infarct should also be sought as this finding confers greater risk of symptomatic intracerebral hemorrhage with tPA treatment *[R]*. It has been recently shown that MRI scans of the brain with diffusion- and susceptibility-weighted (gradient echo) sequences are much more sensitive than CT in detecting new infarction and chronic hemorrhage as well as of equal sensitivity for acute hemorrhage *[C]*. Consequently, when it is possible to perform MRI as quickly as CT with equally expert and timely interpretation, MRI may be used in this situation. Whichever is used, it is recommended that the greatest level of radiologic expertise possible be obtained for interpretation, with the caveat that this CT reading should not create excessive delays in the evaluation and treatment process. A process for rapid teleradiography CT readings should be organized and in place if needed to provide this expertise quickly.

Other Cardiac Assessment as Appropriate (Telemetry)

Consider if Intra-Arterial Thrombolytic Candidate

Intra-arterial thrombolytic therapy may be a treatment option for selected patients presenting in an early time frame but beyond the three-hour time window for intravenous tPA *[R]*.

The availability of this option will be institution dependent, and patients must be highly selected. If considering this treatment option for a patient, a physician must explain to the patient and family that this is not standard of usual care and has substantial risk. Despite the limitations of available study data, in cases of more severe presentation with basilar artery or middle cerebral artery occlusion, intra-arterial thrombolytic treatment may be appropriate because the prognosis without treatment is poor.

If the patient is an appropriate candidate for this treatment, consideration should be given to immediate transfer to an institution offering this intervention. If an endovascular interventionist skilled in this technique is available to the hospital, the patient should be mobilized quickly.

Criteria for consideration of angiographic evaluation for intra-arterial treatment:

- Middle cerebral artery occlusion defined by:
    - Symptom complex consistent with this vascular distribution:
        - Contralateral hemiplegia and face weakness
        - Contralateral hemisensory loss
        - Aphasia if ischemia is on left, "neglect" if on right
        - Commonly, contralateral homonymous visual field deficit, reduced level of arousal, eye deviation toward side of brain ischemia (away from side of weakness)
    - Middle cerebral artery (MCA) "clot sign" on baseline pretreatment CT scan with appropriate clinical presentation
    - CT angiogram, MRA or transcranial Doppler (TCD) demonstration of the occlusion with appropriate clinical presentation

Treatment should begin greater than three hours but less than six hours from onset of symptoms.

- Basilar artery occlusion defined by the following.
    - Symptom complex consistent with this vascular distribution:
        - Quadriparesis, sometimes with posturing bulbar dysfunction (dysarthria, dysphagia, dysphonia)
        - Typically dysconjugate eye movement deficits
        - Commonly, depressed level of arousal, respiratory abnormalities
    - Hyperdense "clot sign" in basilar artery on pretreatment CT scan with appropriate clinical presentation
    - CT angiogram, MRA or TCD demonstration of the occlusion with appropriate clinical presentation

Treatment should begin greater than three hours but less than 12 hours from onset of symptoms.

Refer to the original guideline document for emerging technologies and for information on studies investigating intra-arterial thrombolysis in patients with middle cerebral artery and basilar artery occlusion.

31. **Intervention (Should Occur Concurrently with Evaluation)**

Key Points:

- Apart from treating elevated blood pressure in preparation for thrombolytic therapy, none of these treatments is necessary before administering tPA. They should not delay therapy.
- Education on the suspected diagnosis of ischemic stroke and the possible treatment plans should occur with the patient and family/caregiver.
- Patients with a systolic blood pressure greater than 185 mm Hg or diastolic blood pressure greater than 110 mm Hg are excluded only if the blood pressure remains elevated on consecutive measurements; patients are excluded if aggressive treatment is required to lower the blood pressure into an appropriate range.
- Prevent dehydration in patients by maintaining euvolemia with isotonic fluids. Hypotonic fluids should be avoided because they promote brain swelling.
- Initiate treatment if necessary to correct hyperthermia, hypo- or hyperglycemia, and hypoxia.

Educate Patient and Family

A process should be in place for the patient and family that will rapidly orient them to the suspected diagnosis, ED process, tests to be performed, tPA treatment and its risks, and other treatment measures to be considered. This could include caregiver face-to-face interaction with the patient and family as well as teaching tools in written form. Education should be documented in the medical record.

Treat Hypertension If Greater than 185 Systolic and 110 Diastolic

Patients with an SBP greater than 185 mm Hg or DBP greater than 110 mm Hg are excluded only if the blood pressure remains elevated on consecutive measurements *[R]*, and if aggressive treatment is required to lower the blood pressure into an appropriate range (e.g., if more than a few doses of any medication is required or if nitroprusside drip is required.)

Refer to the original guideline document for discussion of supporting evidence and the American Heart Association (AHA) recommendations for the management of elevated blood pressure in patients with acute ischemic stroke.

Initiate Two IV Lines

Two intravenous lines should be started so that tPA may have a dedicated line.

Start IV Fluids

Treatment with a 0.9% normal saline at a rate of 75 to 125 cc/hr or 2-3 L/day should be administered to avoid dehydration *[R]*. The rate may be adjusted for febrile patients. IV fluids are particularly important for patients in whom oral intake is prevented or limited by swallowing problems. Dehydration is fairly common on admission in stroke patients.

Treat Hyperthermia

Interventions for patients with temperatures of greater than 37.5 degrees C (99.5 degrees F) include appropriate dosing of acetaminophen (1 gram orally or 650 mg rectally every four to six hours, not to exceed 4-6 grams in 24 hours) and regular monitoring of temperature status (every four hours). For those patients with extreme hyperthermia greater than 39.4 degrees C (103 degrees F), aggressive interventions including cooling blankets and ice packs are encouraged. Causes for temperature elevation should be sought and treated.

In human studies, early hyperthermia in acute stroke is associated with increased risk of poor outcome, higher mortality, and increased infarct volume *[B]*, *[D]*, *[M]*. The causality and the relationship of temperature elevation to these poor outcomes are not fully understood. Whether intervention with cooling methods will result in improved outcomes is unknown.

Treat Hyperglycemia

Hyperglycemia may adversely influence clinical outcome.

- Early identification of patients with hyperglycemia in the setting of acute ischemic stroke or in those at risk for cerebral ischemia (ED evaluation of glucose level) is recommended *[C]*.
- Avoid any agents or factors which might induce hyperglycemia.
    - Eliminate glucose from any IV solutions used. (Recommend use of normal saline.)
    - Avoid use of corticosteroids, even in those patients with cerebral edema, as they are not helpful and may be harmful. Separate recommendations are needed for those on maintenance corticosteroids, for concurrent conditions, and treatment decisions are left to the discretion of the physician.
- Use appropriate measures to maintain euglycemia, carefully avoiding hypoglycemia.
- Continue to monitor glucose with bedside testing in those receiving treatment in order to maintain euglycemia.

It remains unclear whether early hyperglycemia in the setting of acute stroke is a marker of physiologic stress or an independent predictor of poor

outcome. Usual management of hyperglycemia (glucose levels greater than 140 mg/dL) with gentle dosing of subcutaneous insulin, avoiding hypoglycemia, in a timely manner during acute ischemia would seem prudent until ongoing clinical trials address the appropriateness of more aggressive treatment measures *[R]*.

33. **Initiate tPA**

Treatment should consist of tPA 0.9 mg/kg intravenously to a maximum dose of 90 mg. Ten percent of this dose should be given as a bolus over one to two minutes and the remainder infused over one hour *[R]*. This dosing may be based upon actual or estimated weight.

35. **Initiate Aspirin Unless Contraindicated**

Key Points:

- Aspirin should be given rectally or via nasogastric (NG) tube promptly in patients who are not tPA candidates unless contraindicated (aspirin allergy, gastrointestinal [GI] bleeding).
- There is no evidence to support therapeutic anticoagulation with unfractionated heparin, low-molecular weight (LMW) heparin or heparinoids. There is, as yet, insufficient evidence to decide whether specific subgroups of ischemic stroke (e.g., dissection, cardio-embolism with intra-cardiac clot) will benefit from therapeutic anticoagulation.
- If a decision is made to use continuous heparin infusion, boluses should be avoided and aPTT should be maintained in the 1.5 to 2 times baseline range.
- Low dose prophylactic parenteral anticoagulation (e.g., enoxaparin, 40 mg subcutaneously daily) is beneficial for prevention of deep vein thrombosis (DVT) or pulmonary embolism (PE) in stroke patients with limited mobility.

Aspirin

Patients who are not candidates for tPA should be given aspirin promptly in a dose of 325 mg *[R]* orally, rectally, or by nasogastric tube and should be continued on a similar daily dose *[R]*. Exceptions to this approach would be justified in those with contraindications to aspirin therapy (e.g., aspirin allergy, gastrointestinal hemorrhage). For patients with an aspirin allergy, 75 mg of clopidogrel may be reasonable. Intravenous loading with 150 to 600 mg of clopidogrel establishes antiplatelet effect more rapidly; however, efficacy in this setting is unproven.

Initiation of aspirin therapy should be withheld for 24 hours for patients who have received tPA.

On September 8, 2006, the Food and Drug Administration issued a Safety Information and Adverse Event Report regarding the concomitant use of low-dose aspirin (for cardioprotective benefits) and ibuprofen (non-steroidal anti-

inflammatory medications [NSAIDs]). The report indicates that 400 mg ibuprofen taken with immediate-release low-dose aspirin (81 mg) will interfere with the antiplatelet effect of aspirin.

Patients who take NSAIDs for other conditions should be instructed to withhold taking NSAIDs for at least 30 minutes after taking their aspirin medication.

Recommendations include taking immediate release low-dose aspirin 30 minutes prior to taking ibuprofen. If ibuprofen is taken first, aspirin should not be taken for at least eight hours after ingestion of ibuprofen. Other analgesics that do not interfere with the antiplatelet effect of aspirin should be considered in populations at high-risk for cardiovascular events.

Enteric-coated aspirin and the concomitant use of ibuprofen is unclear. One study showed that 400 mg ibuprofen interfered with the antiplatelet effect of enteric-coated low-dose aspirin at 2, 7 and 12 hours after ingestion *[C]*.

For more information, please refer to the information listed on the Food and Drug Administration's Web site for a complete copy of the alert and cited references:
http://www.fda.gov/medwatch/safety/2006/safety06.htm#aspirin.

Considerations with Heparin Use

Results from the International Stroke Trial provide powerful evidence against the routine use in patients with acute ischemic stroke, of any heparin regimen as intensive as the moderate-dose subcutaneous regimen utilized in this very large clinical trial (unfractionated heparin - 12,500 units subcutaneous twice daily) *[A]*.

This would include the adjusted-dose, continuous infusion of unfractionated heparin. The commonly cited indications of vertebrobasilar distribution ischemia or ischemic stroke in the setting of atrial fibrillation were analyzed separately and there was no measurable benefit in these specific subgroups. Similarly, the weight of available data regarding use of full dose low-molecular-weight heparin for the acute treatment of stroke do not support their routine use for limiting disability or decreasing mortality in this setting.

The routine use of acute anticoagulation treatment with unfractionated heparin, low-molecular-weight heparin, or heparinoid in acute ischemic stroke is not supported by the available evidence. This treatment does not appear to improve clinical outcome from the index stroke. There may be subgroups who benefit, but further studies of this problem are required for confirmation *[A]*.

Despite these discouraging results, the use of continuous heparin infusion in acute stroke has continued to be common in clinical practice. Given these data, if the decision is made to use full-dose continuous heparin infusion for a specific indication (e.g., large vessel atherothrombosis or dissection), physicians are strongly encouraged to discuss with their patients the lack of proof for this therapy and to detail the potential hazards *[A]*, *[M]*, *[R]*.

Heparin Use for Venous Thromboembolism (VTE) Prophylaxis

Lower doses of these agents, (e.g., enoxaparin 40 mg subcutaneously daily or unfractionated heparin 5,000 units subcutaneously twice daily), are beneficial for the prevention of deep vein thrombosis or pulmonary embolus in those stroke victims with limited mobility and can be advocated for that purpose. Pharmacologic prophylaxis should be considered for patients at high risk for VTE, including an estimated length of stay of four days or more.

For patients at high risk for VTE where pharmacologic prophylaxis is contraindicated, elastic stockings are recommended and intermittent pneumatic compression (IPC) should be used if confined to bed *[R]*.

See the NGC summary of ICSI's guideline Venous Thromboembolism Prophylaxis for more information.

36. **Post-ED Medical Management (Post-Thrombolysis)**
    - **Admit** to intensive care unit or acute stroke care unit/cardiac monitoring.
    - **Perform vital signs and neurologic checks** (not NIHSS) every 15 minutes for two hours, then every 30 minutes for six hours, then every 60 minutes for 24 hours (recommend use of an abbreviated NIHSS for neurologic checks).
    - **Treat BP if greater than 180/105**
        - First 24 hours: Treat if SBP greater than 180 mm Hg or DBP greater than 105 mm Hg.
        - Monitor BP and any corresponding neurologic changes in the ED and first few days of hospitalization.
    - **Initiate bleeding precautions**:
        - Avoid placement of central venous access or arterial puncture for the first 24 hours.
        - Placement of an indwelling bladder catheter should be avoided during drug infusion and for at least 30 minutes after infusion ends.
        - Insertion of a nasogastric tube should be avoided, if possible, during the first 24 hours.
        - Avoid use of anticoagulant, antiplatelet, or non-steroidal anti-inflammatory agents for the first 24 hours.
        - Monitor for central nervous system (CNS) hemorrhage.
    - **If any signs of CNS hemorrhage** (e.g., neurological deterioration, development of severe headache, sudden severe elevation of BP, or new nausea or vomiting) or signs of major systemic hemorrhage institute the following measures:
        - Discontinue infusion of thrombolytic drug.
        - Obtain hemoglobin, hematocrit, partial thromboplastin time, prothrombin time/INR, platelet count, fibrinogen (also type and cross match if transfusions will be needed).
        - Obtain surgical consultation if necessary.
        - Obtain emergent CT head without contrast if CNS hemorrhage suspected.
    - **Initiate antithrombotic therapy** 24 hours after tPA administration (antiplatelet agent or anticoagulant as appropriate).

37. **Post-ED Medical Management (Not a Thrombolysis Candidate)**

Treat BP if greater than 220/120 mm Hg or Mean Arterial Pressure (MAP) greater than 130 mm Hg

Recommendations - Ischemic stroke, **not** a tPA candidate:

- Treat BP only if SBP is greater than 220 mm Hg, DBP is greater than 120 mm Hg, and/or MAP is greater than 130 mm Hg.
- Use easily titrated agents, choosing those with the least effect on cerebrovasculature (labetalol, nitropaste or nicardipine). American Heart Association (AHA) recommendations support oral dosing, but if swallowing is affected, IV agents should be used.

  Note: Dosing examples are included in the original guideline document.

- Avoid agents that tend to cause precipitous drops in BP (e.g., sublingual calcium channel blockers).
- Treat hypotension (IV fluids; treat congestive heart failure or arrhythmia and consider pressors).
- Monitor BP and any corresponding neurologic changes in the ED and first few days of hospitalization. Avoid overtreating BP.

In patients with markedly increased blood pressure on presentation with acute stroke, measured reduction (e.g., 15% reduction targeted for the first 24 hours) is reasonable. The threshold for initiating such treatment remains 220 mm Hg systolic and/or 120 mm Hg diastolic. This is despite preliminary evidence that initiating treatment at a lower level may be safe and beneficial. In patients who are on an anti-hypertensive medication program at the time of the ischemic stroke, these medications should generally be withheld for the initial 24 hours. They should be reinstated after 24 hours, assuming that oral or tube administration is possible and hypotension is not present *[R]*. Many potential reasons for deviating from this general principle exist. For example, suspension of a beta-blocker in a patient with coronary heart disease may be dangerous, and discontinuation of clonidine may cause rebound hypertension.

38. **Other Post-ED Medical Management (First 24 to 48 Hours)**

Continue to Treat Hyperthermia, Hyperglycemia, or Hypoglycemia

Refer to Annotation #31, "Intervention (Should Occur Concurrently with Evaluation)," above.

Initiate DVT Prophylaxis

Consider DVT prophylaxis in any patient admitted to the hospital with lower extremity weakness related to an ischemic stroke. The risk of DVT is high (25% to 50%), and prophylaxis with parenteral anticoagulant decreases the incidence (10% to 20%). The risk of pulmonary embolism appears to be decreased as well, although numbers have been small and statistical significance not achieved *[M]*.

All patients should receive patient education that includes signs and symptoms of VTE and therapy options and encouraged to ambulate early and perform flexion/extension exercises *[R]*. Elastic stockings should be used for patients at high risk for VTE. Intermittent pneumatic compression should be considered for patients at high risk for VTE who have contraindications to pharmacologic prophylaxis.

The PREVAIL Trial compared the low-molecular-weight enoxaparin (40 mg/day) with unfractionated heparin (5,000 units twice daily) for 10 days after stroke preventing walking. There was a 43% reduction in the incidence of venous thromboembolism in the enoxaparin group (10%) compared with the unfractionated heparin group (18%). Overall bleeding rates were similar. Based on this trial, low-molecular-weight heparin is superior to unfractionated heparin in prevention of venous thromboembolism after stroke with inability to ambulate *[A]*.

Low-molecular-weight heparin is renally cleared. For patients with a creatinine clearance (CrCl) less than 30 mL/min, use unfractionated heparin. The patient should be monitored for the possible development of heparin-induced thrombocytopenia (HIT) and bleeding. Obtain a platelet count and hemoglobin every other day beginning on the second day of heparin therapy.

See the NGC summary of the ICSI's guidelines Antithrombotic Therapy Supplement and Venous Thromboembolism Prophylaxis.

Perform Swallow Evaluation

Early evaluation of swallow should be performed in patients at risk of aspiration so that an appropriate diet adjustment may be instituted *[R]*. Patients at risk include those with facial weakness, significant dysarthria, excessive drooling, sputtering, choking, gurgling, wet voice, or pocketing of food in mouth. Clear liquids by mouth and in some cases any food or fluid should be avoided in this setting until a swallow evaluation has established the patient's level of risk for aspiration with the various consistencies.

Bedside swallow assessment or more formal swallow evaluation, and dietary adjustments based on this information, have not been adequately evaluated in sufficiently powered randomized clinical trials. Because these interventions are safe and have a reasonable probability of improving care by decreasing complications, it is reasonable to advocate their use in this setting despite absence of proof of efficacy. Several previously published guidelines advocate these practices *[M]*.

Initiate Rehabilitation Early

Early mobilization within 48 hours of admission in the form of early initiation of appropriate rehabilitation swivels or other nursing intervention is advocated for the purpose of preventing complications related to immobility including deep vein thrombosis, contractures, joint disorders, and pressure sores/decubitus ulcers *[R]*. This recommendation is not based on existing randomized trial data, and it is unlikely that such a trial will be carried out in the future.

Perform Nutritional Status Assessment

Assessment of the patient's baseline nutritional status and the implementation of treatments to correct any major nutritional problems are recommended. Poor nutritional status in patients admitted for stroke is associated with increased morbidity and mortality *[B]*. However, a trial did not find benefit in administering nutritional supplementation *[A]*.

Early Treatment of Ischemic Brain Edema

Although ischemic brain swelling typically peaks between three and five days after stroke onset, marked early swelling (in the first 24 to 48 hours) causing mass effect and tissue shift can occur in the most severe cases ("malignant" ischemic brain edema). Low attenuation changes exceeding two-thirds of the MCA territory and large areas of hypoperfusion on perfusion scans (CT perfusion or MR perfusion) area on initial radiological evaluation are associated with high risk of developing malignant brain edema. Patients with these features should be strictly monitored with serial neurological examinations, ideally in a stroke unit. Repeating CT scan of the brain to evaluate for progression of regional mass effect is indicated if the patient develops any signs of neurological deterioration. The value of serial CT scans of the brain in the absence of clinical changes remains to be established.

Decompressive hemicraniectomy with durotomy improves survival and functional outcome *[M]*. The optimal timing of the procedure is not well established, but most experts recommend early intervention. Improvement in functional outcome has only been shown for patients 60 years old or younger.

Osmotherapy (mannitol 20% or hypertonic saline) may be used to treat ischemic brain edema, but there is very limited data supporting its value *[R]*. Mannitol 20% is usually administered as a bolus of 1 to 2 g/kg of body weight followed by repeated boluses as needed for neurological decline or scheduled doses of 0.25 to 0.5 g/kg every four to six hours. In patients with established signs of herniation, a rescue dose of 23.4% of saline solution (30 cc) may be useful *[D]*.

Hyperventilation should be avoided except for mild to moderate hyperventilation (target pCO_2 30 to 34 mm Hg) for brief periods of time because of the risk of exacerbating ischemia by causing vasoconstriction.

Definitions:

Classes of Research Reports:

A. Primary Reports of New Data Collection:

Class A:

- Randomized, controlled trial

Class B:

- Cohort study

Class C:

- Nonrandomized trial with concurrent or historical controls
- Case-control study
- Study of sensitivity and specificity of a diagnostic test
- Population-based descriptive study

Class D:

- Cross-sectional study
- Case series
- Case report

B. Reports that Synthesize or Reflect upon Collections of Primary Reports:

Class M:

- Meta-analysis
- Systematic review
- Decision analysis
- Cost-effectiveness analysis

Class R:

- Consensus statement
- Consensus report
- Narrative review

Class X:

- Medical opinion

CLINICAL ALGORITHM(S)

Detailed and annotated clinical algorithms are provided for:

- Screening (Ambulatory)
- Emergency Department (ED) Treatment
- Stroke Code

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is classified for selected recommendations (see "Major Recommendations").

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Appropriate screening and referral for patients presenting with neurological symptoms
- Rapid evaluation and treatment of patients who are candidates for thrombolytic therapy
- Improved management of ischemic stroke
- Effective prevention of stroke progression/recurrence
- Decreased mortality and morbidity associated with ischemic stroke

POTENTIAL HARMS

- Adverse effects of thrombolytic drugs can include signs of central nervous system hemorrhage (e.g., neurologic deterioration, development of severe headache, sudden severe elevation of blood pressure, or new nausea or vomiting) or signs of major systemic hemorrhage.
- Concomitant use of immediate-release low-dose aspirin (81 mg) and ibuprofen (400 mg) will interfere with the antiplatelet effect of aspirin.

CONTRAINDICATIONS

CONTRAINDICATIONS

Contraindications for Tissue Plasminogen Activator (tPA)

Clinical Contraindications

- Clearly defined onset of stroke greater than 3 hours prior to planned start of treatment; if the patient awakens with symptoms, onset is defined as the time of the last known baseline neurological status prior to retiring
- Rapidly improving symptoms
- Mild stroke symptoms/signs (National Institutes of Health Stroke Scale less than 4): sensory symptoms only, ataxia without other deficits, dysarthria without other deficits, mild motor signs (non-disabling), and visual field defect without other deficit
- In the setting of middle cerebral artery (MCA) stroke, an obtunded or comatose state may be a relative contraindication.
- Clinical presentation suggestive of subarachnoid hemorrhage regardless of computed tomography result
- Hypertension--systolic blood pressure (SBP) greater than 185 mm Hg or diastolic blood pressure (DBP) greater than 110 mm Hg. Patients with a systolic blood pressure greater than 185 mmHg or diastolic blood pressure greater than 110 mmHg are excluded only if the blood pressure remains elevated on consecutive measurements, or if aggressive treatment is required to lower the blood pressure into an appropriate range.

History Contraindications

- Minor ischemic stroke within the last month
- Major ischemic stroke or head trauma within the last three months
- History of intracerebral or subarachnoid hemorrhage if recurrence risk is substantial
- Untreated cerebral aneurysm, arteriovenous malformation (AVM), or brain tumor
- Gastrointestinal or genitourinary hemorrhage within the last 21 days
- Arterial puncture at a noncompressible site within the last 7 days or lumbar puncture within the last three days
- Major surgery or major trauma within the last 14 days
- Clinical presentation suggestive of acute myocardial infarction (MI) or post-myocardial infarction pericarditis
- Patient taking oral anticoagulants and international normalized ratio (INR) greater than 1.7
- Patient receiving heparin within the last 48 hours and having an elevated activated partial thromboplastin time (aPTT)
- Patient receiving low-molecular-weight heparin within the last 24 hours
- Pregnant, or anticipated pregnant, female
- Known hereditary or acquired hemorrhagic diathesis or unsupported coagulation factor deficiency

Laboratory Contraindications

- Glucose less than 50 or greater than 400 mg/dL
- Platelet count less than 100,000/mm^3
- INR greater than 1.7
- Elevated activated partial thromboplastin time
- Positive pregnancy test

Radiology Contraindications

- Intracranial hemorrhage
- Large area of low attenuation consistent with an infarcted brain

  Early changes of this type suggest that onset of symptoms occurred earlier than the history first indicated. Recheck patient history and time of symptom onset.

- Intracranial tumor, aneurysm, arteriovenous malformation or other space-occupying lesion

Contraindications to Aspirin (ASA) Therapy

- Aspirin allergy
- Gastrointestinal hemorrhage

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- These clinical guidelines are designed to assist clinicians by providing an analytical framework for the evaluation and treatment of patients, and are not intended either to replace a clinician's judgment or to establish a protocol for all patients with a particular condition. A guideline will rarely establish the only approach to a problem.
- This clinical guideline should not be construed as medical advice or medical opinion related to any specific facts or circumstances. Patients are urged to consult a health care professional regarding their own situation and any specific medical questions they may have.
- The guideline work group recognizes that two time frames are critically important in the overall outcome, and fall outside the defined scope. They are prehospital care, and continuing care of stroke patients after 48 hours, which includes the development of a long term secondary prevention strategy. While the group has not itself performed a systematic review of the primary evidence on these matters, they recommend the guidelines from the American Heart Association, American Stroke Association, and the Council on Cardiovascular Radiology and Interventions and the American Academy of Neurology.
- **Hyperthermia**. In human studies, early hyperthermia in acute stroke is associated with increased risk of poor outcome, high mortality, and increased infarct volume. The causality and the relationship of temperature elevation to these poor outcomes are not fully understood. Whether intervention with cooling methods will result in improved outcomes is unknown.
- **Hyperglycemia**. It remains unclear whether early hyperglycemia in the setting of acute stroke may be a marker of physiologic stress or an independent predictor of poor outcome. Usual management of hyperglycemia with gentle dosing of subcutaneous insulin, avoiding hypoglycemia, in a timely manner during acute ischemia would seem prudent until ongoing clinical trials address the appropriateness of more aggressive treatment measures.
- **Heparin**. The routine use of acute anticoagulation treatment with unfractionated heparin, low-molecular-weight heparin, or heparinoid in acute ischemic stroke is not supported by the available evidence. This treatment does not appear to improve clinical outcome from the index stroke. There may be subgroups who benefit, but further studies of this problem are required for confirmation.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

Once a guideline is approved for general implementation, a medical group can choose to concentrate on the implementation of that guideline. When four or more groups choose the same guideline to implement and they wish to collaborate with others, they form a guideline action group.

In the action groups, each medical group sets specific goals they plan to achieve in improving patient care based on the particular guideline(s). Each medical group shares its experiences and supporting measurement results within the action group. This sharing facilitates a collaborative learning environment. Action group learnings are also documented and shared with interested medical groups within the collaborative.

Currently, action groups may focus on one guideline or a set of guidelines such as hypertension, lipid treatment, and tobacco cessation.

The following aims were identified by the guideline work group as key areas in which medical groups may receive benefits in implementing this guideline.

Priority Aims and Suggested Measures

1. Increase the percentage of patients presenting within three hours of stroke onset who are evaluated within 10 minutes of arriving in the emergency department (ED).

   Possible measure for accomplishing this aim:

   a. Percentage of patients presenting within three hours of stroke onset who are evaluated by a physician within 10 minutes of arriving in the ED.

2. Increase the percentage of patients presenting with transient ischemic attack (TIA) symptoms within 24 hours at high risk for stroke who are admitted to the hospital.

   Possible measure for accomplishing this aim:

   a. Percentage of patients admitted who have documentation of TIA symptoms within the last 24 hours.

3. Increase the percentage of patients receiving appropriate thrombolytic and antithrombotic therapy for ischemic stroke (use of tissue plasminogen activator [tPA] and aspirin).

   Possible measures for accomplishing this aim:

   a. Percentage of eligible patients presenting with ischemic stroke treated with tPA.
   b. Percentage of patients who are not candidates for tPA treatment who receive aspirin within 24 hours of hospitalization, after a negative head computed tomography (CT) scan, unless contraindicated.
   c. Percentage of patients receiving tPA who are treated according to guideline (refer to Annotations #29 and #32).
   d. Percentage of patients who are candidates for tPA with a "door to drug" time (time of arrival to time of drug administration) of less than 60 minutes.
   e. Percentage of patients who undergo a CT scan within 25 minutes of arrival in the ED.

4. Increase the percentage of non-tPA recipients who have hypertension appropriately managed in the first 48 hours of hospitalization or until neurologically stable.

   Possible measure for accomplishing this aim:

a. Percentage of non-tPA recipients who have hypertension appropriately managed according to the guideline (refer to Annotation #32).

5. Increase the percentage of patients who receive appropriate medical management for prevention of complications within the initial 24 to 48 hours of diagnosis including:
   - Continue to treat hypoglycemia or hyperglycemia
   - Continue to treat hyperthermia
   - Continue intravenous (IV) fluids
   - Continue to treat hypoxia
   - Initiate deep vein thrombosis prophylaxis
   - Perform swallow evaluation
   - Initiate early rehabilitation (early mobilization)
   - Perform nutritional status assessment

   Possible measures for accomplishing this aim:

   a. Percentage of patients who receive appropriate intervention for hypoglycemia and hyperglycemia.
   b. Percentage of patients who receive appropriate intervention for hyperthermia.
   c. Percentage of patients who receive IV fluids.
   d. Percentage of patients who receive appropriate treatment for hypoxia.
   e. Percentage of patients with ischemic stroke with paralysis or other reason for immobility receiving appropriate prevention for venous thromboembolism (subcutaneous heparin or pneumatic compression device).
   f. Percentage of patients who are at risk for aspiration who receive an early swallow evaluation.
   g. Percentage of patients mobilized from bed within 48 hours of admission.

6. Improve patient and family education of patients with ischemic stroke in both the ED and the admitting hospital unit.

   Possible measures for accomplishing this aim:

   a. Percentage of patients presenting in the ED with ischemic stroke for whom patient/family education is documented in the medical record.
   b. Percentage of patients admitted to a hospital unit with ischemic stroke for whom patient/family education is documented in the medical record.

At this point in development for this guideline there are no specifications written for possible measures listed above. The Institute for Clinical Systems Improvement (ICSI) will seek input from the medical groups on what measures are of most use as they implement the guideline. In a future revision of the guideline one or two measurement specifications may be included.

Key Implementation Recommendations

The following system changes were identified by the guideline work group as key strategies for health care systems to incorporate in support of the implementation of this guideline.

1. Hospitals should consider developing and implementing critical pathways, standing orders and a stroke process to accomplish rapid evaluation and treatment.
    a. Established process for expediting the evaluation and treatment of patients who are candidates for intravenous tPA
    b. Presence of standing orders for acute stroke to include:
        - Ongoing antithrombotic therapy
        - Management of blood pressure
        - Early mobilization
        - Use of appropriate anti-embolism treatment in the paralyzed patient

2. A process should be in place for the patient and family that will rapidly orient them to the suspected diagnosis, ED process, tests to be performed, tPA treatment and its risks, and other treatment measures to be considered. This could include both caregiver face-to-face interactions with the patient and family as well as teaching tools in written form.

System Improvement

There is evidence that benchmarking can guide and drive quality improvement. Using essentially the same quality indicators as the Joint Commission for Accreditation of Healthcare Organizations (JCAHO) and ICSI, programs like the American Heart Association's Get with The Guidelines-Stroke and the Paul Coverdell National Acute Stroke Registry have been shown to improve the quality of stroke care.

The Joint Commission (TJC) Primary Stroke Center Certification

TJC offers certification as Primary Stroke Centers to hospitals that meet specific qualifications. The emphasis of the process is on the early recognition and management of stroke and the scope of accreditation includes integrated efforts in public awareness, emergency medical services, emergency room and hospitalization.

Refer to the original guideline document for information regarding the requirements for certification.

IMPLEMENTATION TOOLS

Chart Documentation/Checklists/Forms
Clinical Algorithm
Pocket Guide/Reference Cards

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness
Patient-centeredness
Timeliness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Institute for Clinical Systems Improvement (ICSI). Diagnosis and treatment of ischemic stroke. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2008 Jun. 57 p. [146 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2001 Oct (revised 2008 Jun)

GUIDELINE DEVELOPER(S)

Institute for Clinical Systems Improvement - Private Nonprofit Organization

GUIDELINE DEVELOPER COMMENT

Organizations participating in the Institute for Clinical Systems Improvement (ICSI): Affiliated Community Medical Centers, Allina Medical Clinic, Altru Health System, Aspen Medical Group, Avera Health, CentraCare, Columbia Park Medical Group, Community-University Health Care Center, Dakota Clinic, ENT Specialty Care, Fairview Health Services, Family HealthServices Minnesota, Family Practice Medical Center, Gateway Family Health Clinic, Gillette Children's Specialty Healthcare, Grand Itasca Clinic and Hospital, HealthEast Care System, HealthPartners Central Minnesota Clinics, HealthPartners Medical Group and Clinics, Hutchinson Area Health Care, Hutchinson Medical Center, Lakeview Clinic, Mayo Clinic, Mercy Hospital and Health Care Center, MeritCare, Mille Lacs Health System, Minnesota Gastroenterology, Montevideo Clinic, North Clinic, North Memorial Care System, North Suburban Family Physicians, Northwest Family Physicians, Olmsted Medical Center, Park Nicollet Health Services, Pilot City Health Center, Quello Clinic, Ridgeview Medical Center, River Falls Medical Clinic, Saint Mary's/Duluth Clinic Health System, St. Paul Heart Clinic, Sioux Valley Hospitals

and Health System, Southside Community Health Services, Stillwater Medical Group, SuperiorHealth Medical Group, University of Minnesota Physicians, Winona Clinic, Ltd., Winona Health

ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; e-mail: icsi.info@icsi.org; Web site: www.icsi.org.

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GUIDELINE COMMITTEE

Cardiovascular Steering Committee

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Work Group Members: David Anderson, MD (Work Group Leader) (University of Minnesota Physicians and Hennepin Faculty Associates) (Neurology); David Larson, MD (Ridgeview Medical Center) (Emergency Medicine); James Lee, MD, MPH (RiverWay Clinics) (Family Medicine); Joseph McRaith, MD (Allina Medical Clinic) (Hospitalist); Bret Haake, MD (HealthPartners Medical Group and Regions Hospital) (Neurology); Kamakshi Lakshminarayan, MD (University of Minnesota Physicians) (Neurology); Alejandro Rabinstein, MD (Mayo Clinic) (Neurology); Gail Wallace, RN, BSN, CCRN (St. Mary's/Duluth Clinic Health System) (Nursing); Jeff Larson, PharmD (Park Nicollet Health Services) (Pharmacy); Teresa Hunteman, MA, CPHQ (Institute for Clinical Systems Improvement) (Measurement/Implementation Advisor); Linda Setterlund, MA, CPHQ (Institute for Clinical Systems Improvement) (Facilitator)

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ICSI has adopted a policy of transparency, disclosing potential conflict and competing interests of all individuals who participate in the development, revision and approval of ICSI documents (guidelines, order sets and protocols). This applies to all work groups (guidelines, order sets and protocols) and committees (Committee on Evidence-Based Practice, Cardiovascular Steering Committee, Women's Health Steering Committee, Preventive & Health Maintenance Steering Committee and Respiratory Steering Committee).

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No work group members have potential conflicts of interest to disclose.

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GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Institute for Clinical Systems Improvement (ICSI). Diagnosis and initial treatment of ischemic stroke. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2007 Feb. 68 p.

ICSI scientific documents are revised every 12 – 36 months as indicated by changes in clinical practice and literature.

GUIDELINE AVAILABILITY

Electronic copies: Available from the Institute for Clinical Systems Improvement (ICSI) Web site.

Print copies: Available from ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; Web site: www.icsi.org; e-mail: icsi.info@icsi.org.

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Diagnosis and initial treatment of ischemic stroke. Executive summary. Bloomington (MN): Institute for Clinical Systems Improvement, 2008 Jun. 2 p. Electronic copies: Available from the Institute for Clinical Systems Improvement (ICSI) Web site.
- ICSI pocket guidelines. May 2007 edition. Bloomington (MN): Institute for Clinical Systems Improvement, 2007.

Print copies: Available from ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; Web site: www.icsi.org; e-mail: icsi.info@icsi.org.

Additionally, Appendix B in the original guideline document includes Non- National Institute of Health Stroke Scale (NIHSS) Neuro Checks.

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI on August 26, 2002. The information was verified by the guideline developer on September 23, 2002. This summary

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